

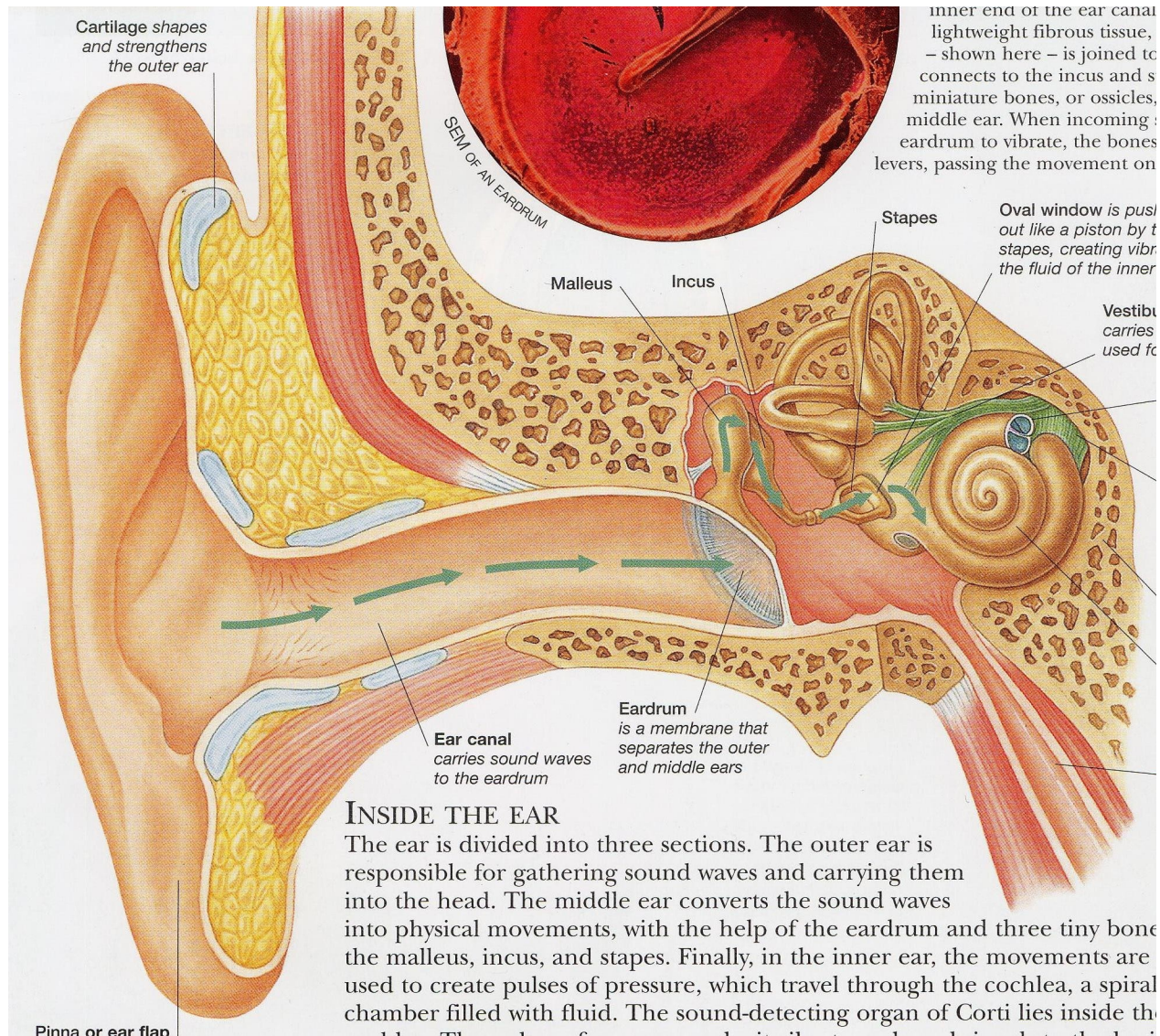
Navy and USMC Hearing Conservation Programs

19 November 2007

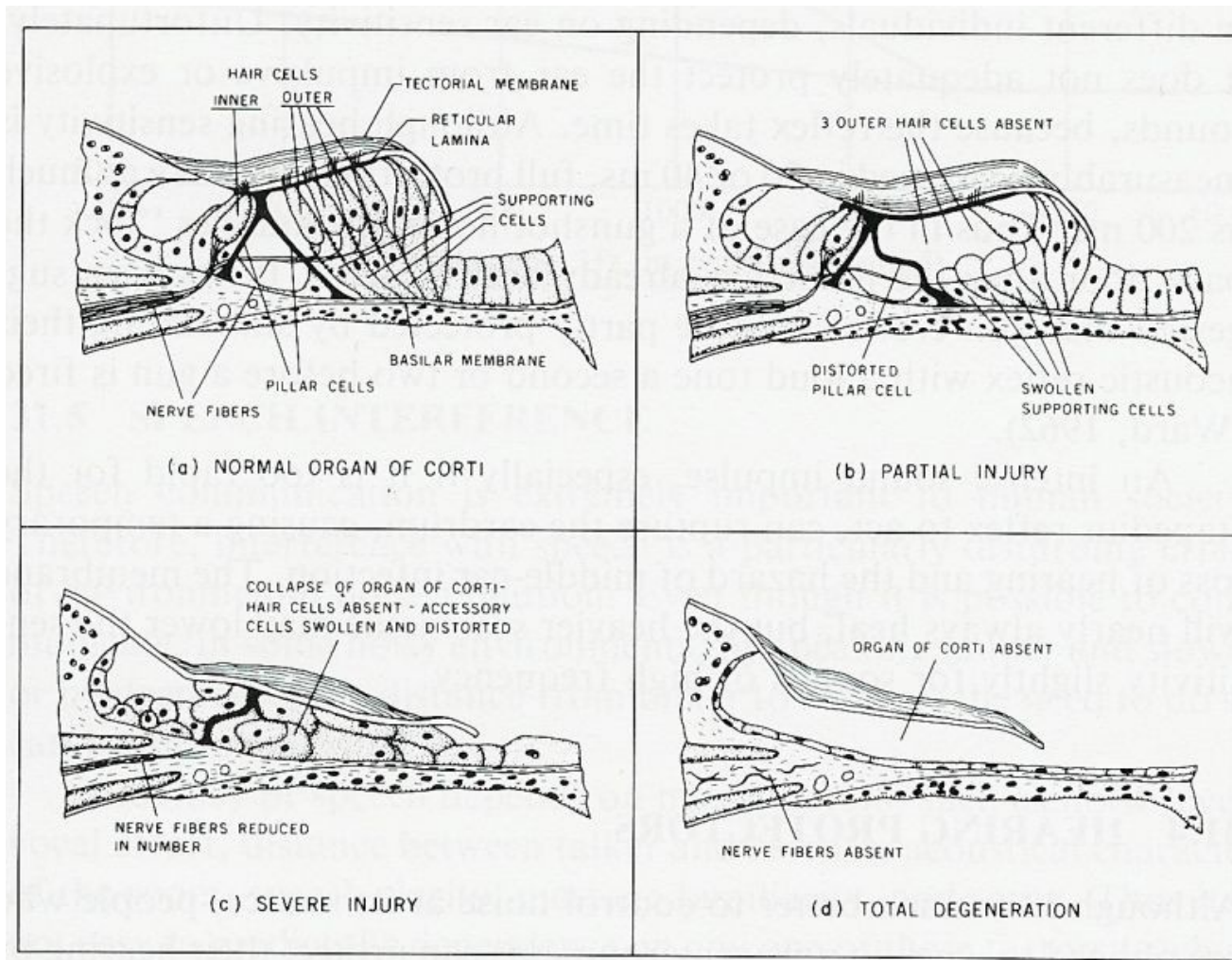
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BUMED M44

Outline

- Sound and exposure
- Hearing loss
- Navy Hearing Conservation Program overview
- Data sources and issues
- Disconnects
- Recommendations



Cochlear Hair Cell Damage



EFFECTS OF NOISE ON MAN

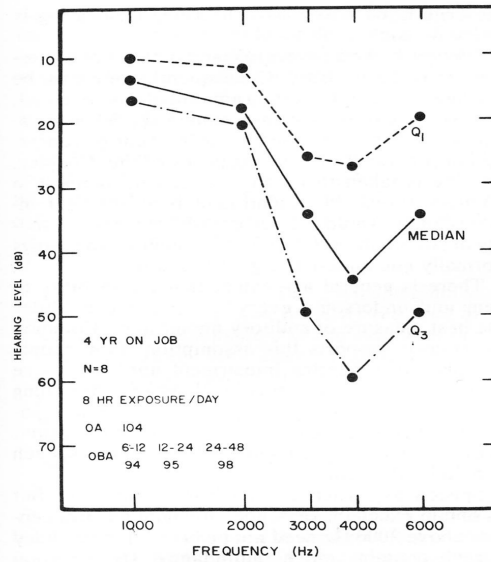


Figure 7.2—Noise-induced permanent threshold shift after four years on the job.

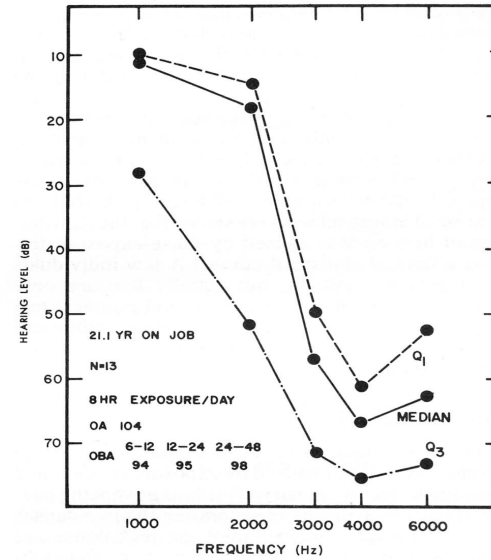


Figure 7.4—Noise-induced permanent threshold shift after twenty-one years on the job.

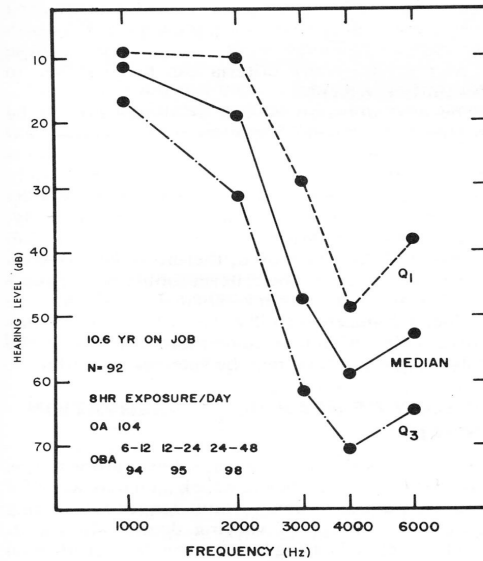


Figure 7.3—Noise-induced permanent threshold shift after ten years on the job.

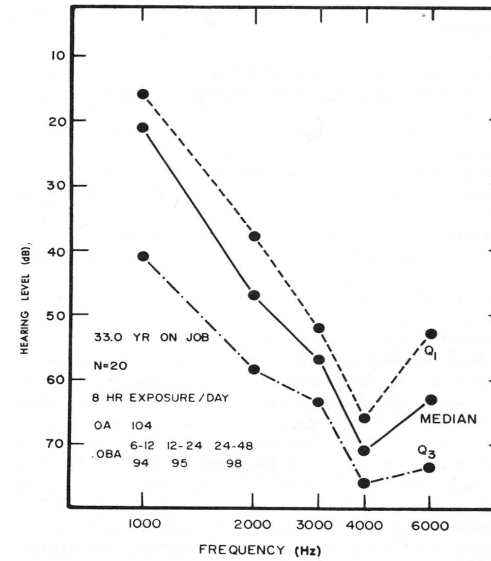
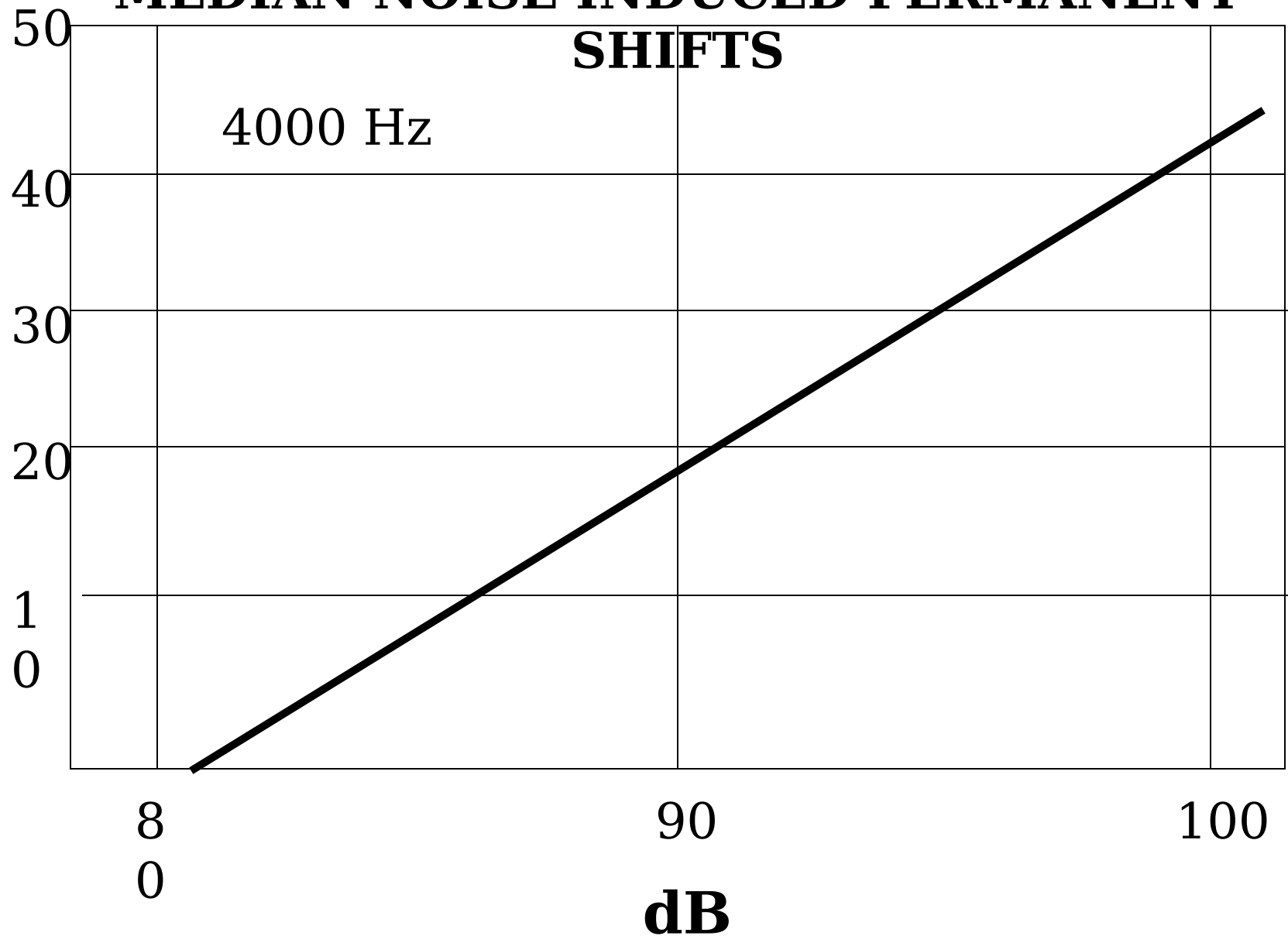


Figure 7.5—Noise-induced permanent threshold shift after thirty-three years on the job.

MEDIAN NOISE INDUCED PERMANENT SHIFTS



Sound Exposure

- Total sound energy absorbed over time determines injury
 - Impact, blast injury, extremely high dB must be evaluated differently
 - Compliance standards do not guarantee 100% protection
- Compliance standards exist for impact noise
- Concurrent chemical exposures may exacerbate hearing loss (toluene, oxidants)
- Lifestyle factors contribute
 - May not be as consistent or greater in severity than industrial exposures

Sound Exposure Standards

- OSHA PEL: 90 dB - 8 hour
 - 85 dB admin controls
- ACGIH TLV: 85 dB - 8 hour
 - 80 dB over 24 hours
- European: 85 dB - 8 hour
- Navy: 84 dB – 8 hour; 16 hour exposure formula

Acceptable Equivalent Sound Energy Exposure

**Sound energy doubles every
3 dB**

<u>Allowed Time</u>	<u>dB</u>
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8 hours	90 dB
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4 hours	93 dB
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2 hours	96 dB
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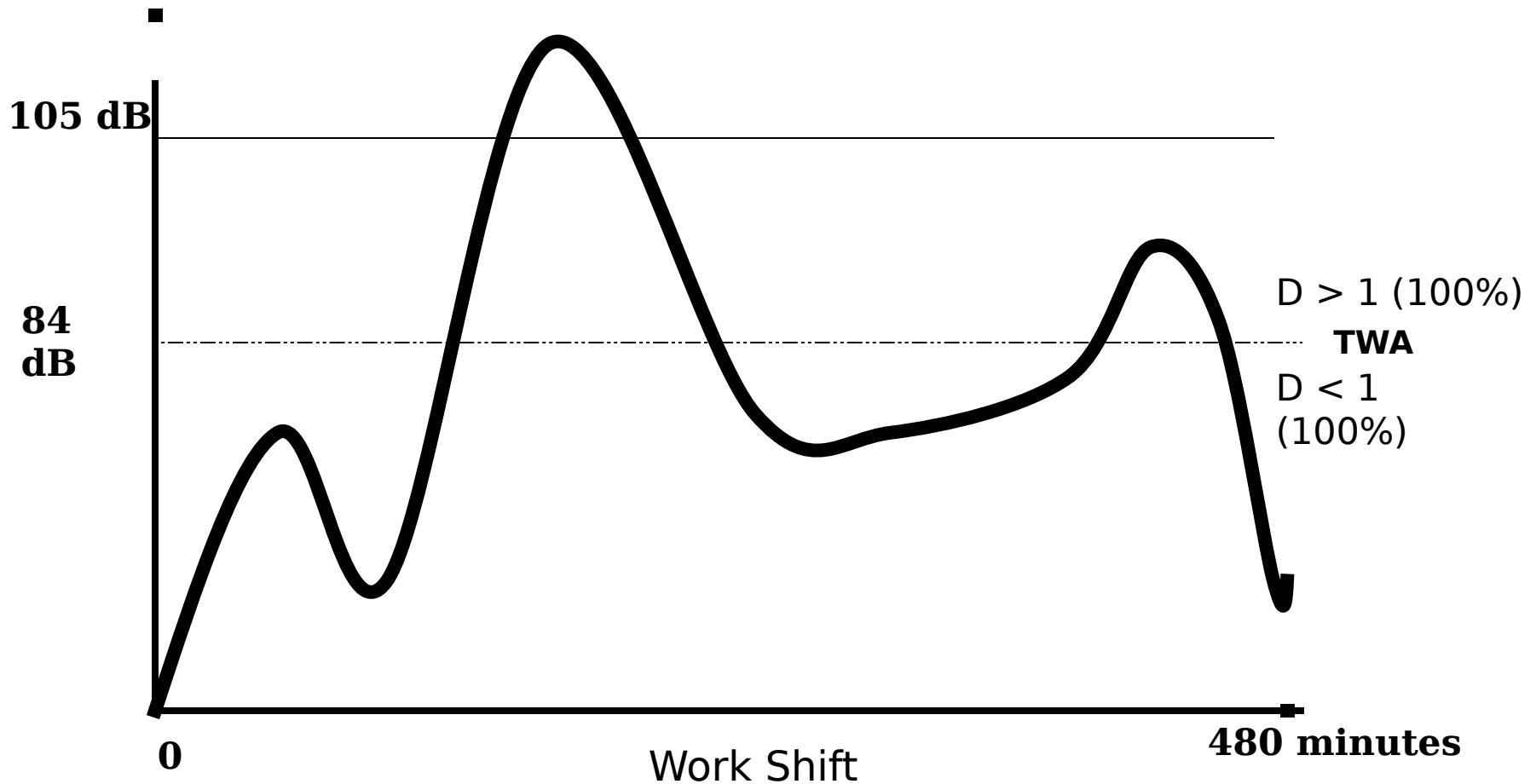
1 hour	99 dB
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30 min	102 dB
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15 min	105 dB
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Dose and TWA Measure

(must be calculated)



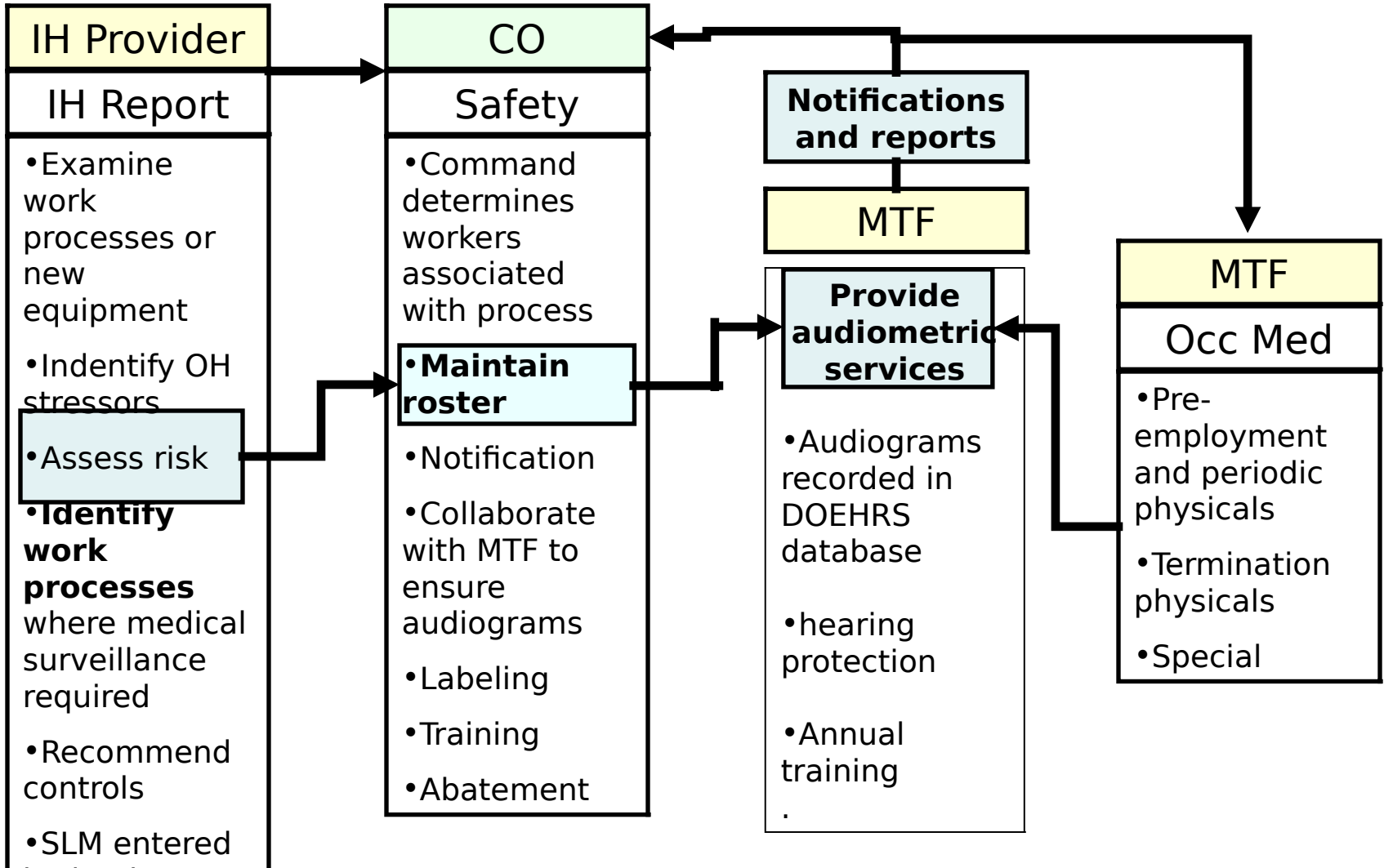
Navy Hearing Conservation Program

- Must meet or exceed federal OSHA
- Comprised of
 - Identification and assessment of risk (IH)
 - Mitigation of risk (Commands / SYSCOMs / policy)
 - PPE
 - Administrative
 - Engineering changes
 - Design parameters
 - Early recognition of injury and monitoring (Audiograms)
 - Designed for individuals not populations

Sound Exposure Controls

- Replacement, maintenance
- Engineering
 - enclosures, damping material, muffling
 - Commands may not be able to complete due to funding or design constraint
- Distance:
- Protective equipment
 - Plugs (-10 to -30 dB), muffs (-10 to -20 dB)
 - Active noise reduction
 - Navy is currently at PPE limit
- Time limitation

Hearing Conservation Overview



Noise Contribution

(Deployed Setting)

Work

- Industrial exposures
- Aircraft
- Heavy Equipment
- Headphones
- Scullery

Non-Work

- Headphones
- Lounge areas
- Ambient noise (> 80 dB?)

Ashore: ability to recover

Design:
Habitability
criteria important

Rest

- Ambient noise (80 – 90 dB?)

Ashore: ability to recover

Design:
Habitability
criteria important

Audiogram and Population Data

- Audiograms will have limited value in noise exposure risk reduction
 - audiograms detect changes early in individuals
 - do not determine cause
 - cannot separate enforcement, exposure / dose, equipment design issues
 - causal exposures not recorded in DOEHRS, can only be assumed based on enlisted rate
 - many hazardous noise exposures are rate independent
 - no Navy enlisted rate cohort has a consistent exposure profile
 - many changing or confounding variables

Audiogram Changes

- Changes from baseline not the last audiogram
 - Baseline may be 5 – 15 years old
 - Unsure what may be attributable to presbycusis
 - STS defined changes are 10 db average over 3 frequencies (3, 4, 6 kHz)
 - Inadequate follow ups may inflate STS rate
- Audio-booth differences
- Attentiveness
- STS patients counseled on hearing loss and prevention

DOEHRS Data Repository

- Currently checking what percent of audiograms can be graded mild to severe hearing loss based on recorded threshold
- Currently checking what percent of Navy personnel leaving service have compensable loss
- Multiple 2216?
- Can extract OSHA reportable criteria case numbers (threshold > 40).
 - Needs more analysis – 780 records for FY 06.

VA New Cases (Navy)

- Anecdotaly there is belief new cases created for hearing loss are predominantly retiree population already in the system (WWII, Viet Nam era, etc)
 - Vets with 10% disability of any kind eligible for hearing aid assistance
- Other explanations postulated but difficult to validate

IH Not Always Part of the Engineering or Design Solution

- Identification of problems left at command level
 - result in low level solutions
 - engineering recommendations left with command to forward to appropriate authority
 - Limited funds for after the fact changes
- Limited impact at SYSCOM or with acquisition process

IH Data

- Most exposure data at NEHC (NOED)
 - may have problems with consistent nomenclature, equipment, spaces
 - database will have measured sound levels, TWA, locations, work process
- DOEHRS IH data repository not available until FY 11
- However, probably could extract NOED high noise hazard risk processes and areas or processes with sound levels exceeding effective protection

Acquisition

- Improvement in some areas
 - generational changes (1950 / 1960 compared to 1990s)
 - Specific stressors have been mitigated fairly well (RFR/MW, ionizing rad, HF)
- Program Manager and PEO define acceptable risk
- “Safety” viewed mostly compliance not risk based
- Want a solid design threshold
- Performance vrs Survivability vrs Occupational Health balance

What Does Acquisition Need?

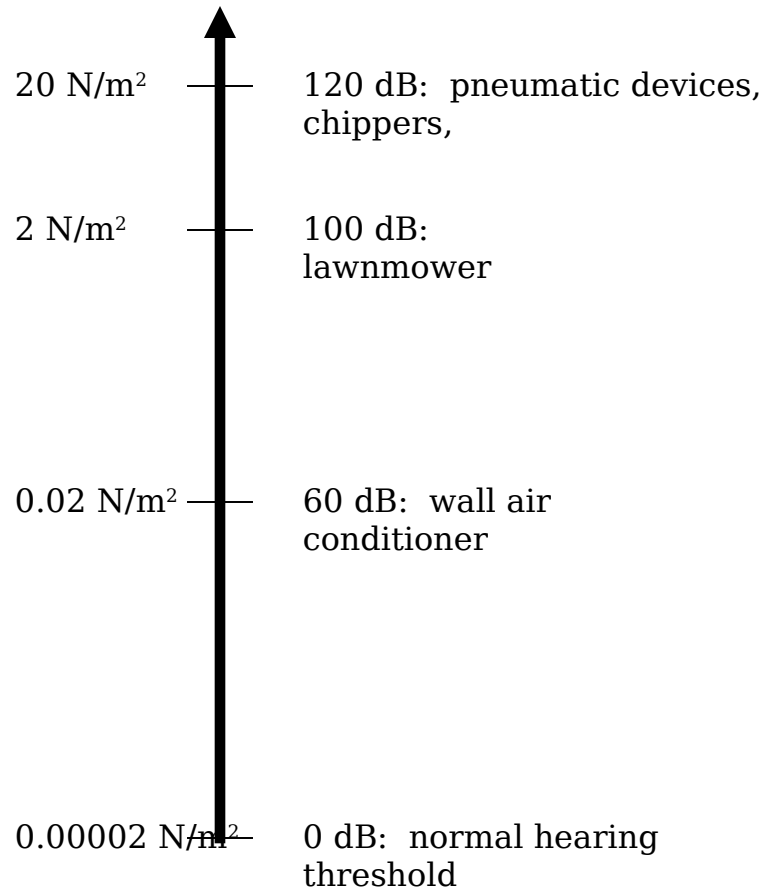
- Need to know current measured risks
 - equipment dB
 - ambient space dB
 - current vehicle occupant dB
- Measured risks with inadequate protection or controls
- Estimated long term morbidity?
 - ie, full 90 dB exposure -> 12% to 18% shift

Key Areas for Consideration

- Who / What is the QA for acceptable risk?
- We are at the technologic limit for PPE
 - Flight deck poses extreme problem
 - However, there are probably a number of non-flight deck engineering solutions
- Can we provide the top 10, top 5 noise exposures to PEOs?
- We need systemic changes and more OH expertise toward the acquisition process
- We need a better SOH – engineer – PEO interface
- SOH must engage system safety / HFE early.
Must provide appropriate language in requirements and design documents

Back ups

Decibel Concept



$$dB = 20 \log \frac{P}{P_0}$$

P = measured pressure
(N/m²)
 P_0 = reference pressure
(0.00002 N/m²)

Dose and TWA Calculations (Industry)

$$D = \frac{100}{T_c} \sum_{i=1}^N 10^{\frac{(L_{AS} - L_c) T_i}{q}}$$

$$T = \frac{8}{2^{(L-90)/5}}$$

$$D = 100 \left[\frac{C_1}{T_1} + \frac{C_2}{T_2} + \dots + \frac{C_n}{T_n} \right]$$

$$TWA = 16.61 \log_{10} \left[\frac{D}{100} \right] + 90$$

How do we identify groups of Navy and Marine Corps personnel with hearing loss?

Normally individuals rather than groups are identified with hearing loss by hearing testing via the Defense Occupational & Environmental Health Readiness System – Hearing Conservation (DOEHRS-HC) and uploaded to DOEHRS-HC, Data Repository (DR)

- “Hearing loss” depends upon a working definition, e.g., mild, moderate, severe, profound; what is the amount of hearing required to do job; is the hearing loss compensable, etc..

How do we identify groups of Navy and Marine Corps personnel with hearing loss?

Groups (jobs) may be identified as having changes in hearing or STS/PTS (Significant Threshold Shift/Permanent Threshold Shift) which is then associated with noise exposure profiles.

1. Caution must be exercised in drawing conclusions:
 - neither STS or PTS, a trigger for intervention, necessarily equate to a functional “hearing loss” ;
 - STS rate is also influenced by failure to complete follow up testing.

How do we identify groups of Navy and Marine Corps personnel with hearing loss?

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2. A small number in any one job category can / does greatly influence STS/PTS.

- In 2006 there were 3,098 Navy and 1,964 Marine occupational categories recorded, many with 1 to a couple dozen individuals in each category. When one of one sustains an STS/PTS that makes the rate 100%. Overall STS rate is approximately 15%.

How do we identify groups of Navy and Marine Corps personnel with hearing loss?

ICD-9 (diagnostic codes) Standard Ambulatory Data Record (**SADR**)/ Standard Inpatient Data Record (**SIDR**) could be searched however there is no association with job codes and would require individual SSN to search. In addition SADR/SIDR only returns limited number of the top codes in pt. history.

**How do we collect data identifying
numbers of current Sailors and Marines
where they worked**

Industrial Hygiene survey data

What noise sources contributed to their hearing loss?

Any continuous noise exposure in excess of 84 dBA (e.g. loud truck) or impact/impulse noise that equals or exceeds 140 dB Peak (e.g., small handgun) is considered potentially hazardous.

– Other non-noise contributors:

- Variety of medical conditions
- Certain chemical / pharmaceutical exposures
- Head trauma
- Aging